

Claims

1. Process for the production of an aqueous sol containing silica-based particles which comprises:

- (a) acidifying an aqueous silicate solution to a pH of from 1 to 4 to form an acid sol;
- 5 (b) alkalisising the acid sol at an  $\text{SiO}_2$  content within the range of from 4.5 to 8% by weight to a pH of at least 7;
- (c) allowing particle growth of the alkalisised sol for at least 10 minutes;
- (d) alkalisising the obtained sol to a pH of at least 10.0; and
- (e) optionally concentrating the sol obtained according to (b), (c) or (d) to provide an
- 10 aqueous sol containing silica-based particles and having a specific surface area of at least  $90 \text{ m}^2/\text{g}$  aqueous sol.

2. Process for the production of an aqueous sol containing silica-based particles which comprises:

- (a) acidifying an aqueous silicate solution to a pH of from 1 to 4 to form an acid sol;
- 15 (b) alkalisising the acid sol at an  $\text{SiO}_2$  content within the range of from 4.5 to 8% by weight;
- (c) heat-treating the alkalisised sol at a temperature of at least  $30^\circ\text{C}$ ;
- (d) alkalisising the heat-treated sol to a pH of at least 10.0; and
- (e) optionally concentrating the sol obtained according to (b), (c) or (d) to provide an
- 20 aqueous sol containing silica-based particles and having a specific surface area of at least  $90 \text{ m}^2/\text{g}$  aqueous sol.

3. Process according to claim 1 or 2, characterised in that it comprises (e) concentrating the sol obtained according to (c) or (d) to provide a sol having a specific surface area of at least  $95 \text{ m}^2/\text{g}$  aqueous sol.

4. Process according to claim 1, 2 or 3, characterised in that the

25 alkalisation according to (b) and (d) is carried out by means of an aqueous silicate solution.

5. Process according to any of claims 1 to 4, characterised in that the particle growth and heat-treatment according to (c) is carried out at a temperature within the range of from  $35$  to  $95^\circ\text{C}$ .

30 6. Process according to any of claims 1 to 5, characterised in that the particle growth and heat-treatment according to (c) is carried out for 20 to 240 minutes.

7. Process according to any of claims 1 to 6, characterised in that the alkalisation according to (d) produces a sol having a molar ratio of  $\text{SiO}_2$  to  $\text{M}_2\text{O}$ , where M is alkali metal or ammonium, within the range of from 15:1 to 30:1 and a pH of

35 at least 10.6.

8. Process according to any of claims 1 to 7, characterised in that it further comprises addition of an aluminium-containing compound and/or a boron-containing compound.

9. Process according to any of claims 1 to 8, characterised in that  
5 the silica-based particles obtained have a specific surface area of at least 550 m<sup>2</sup>/g SiO<sub>2</sub>.

10. Aqueous sol containing silica-based particles obtainable by a process according to any of claims 1 to 9.

11. Aqueous sol containing silica-based particles, characterised in that it has a specific surface area of at least 115 m<sup>2</sup>/g aqueous sol and the silica-based  
10 particles have a specific surface area of at least 550 and less than 1000 m<sup>2</sup>/g SiO<sub>2</sub>.

12. Aqueous sol containing silica-based particles, characterised in that it has a specific surface area of at least 115 m<sup>2</sup>/g aqueous sol and an S-value within the range of from 10 to 45%.

13. Aqueous sol according to claim 11 or 12, characterised in that it  
15 has a molar ratio of SiO<sub>2</sub> to M<sub>2</sub>O, where M is alkali metal or ammonium, within the range of from 15:1 to 40:1.

14. Aqueous sol according to claim 12 or 13, characterised in that the silica-based particles have a specific surface area of at least 550 m<sup>2</sup>/g SiO<sub>2</sub>.

15. Aqueous sol according to any of claims 11 to 14, characterised  
20 in that it has an S-value within the range of from 25 to 35%.

16. Aqueous sol according to any of claims 11 to 15, characterised in that it has a silica content of at least 10% by weight.

17. Use of an aqueous sol containing silica-based particles according to any of claims 10 to 16 or produced by a process according to any of claims 1 to 9 as a drainage  
25 and retention aid in the production of paper.

18. Process for the production of paper from an aqueous suspension containing cellulosic fibres, and optional fillers, which comprises adding to the suspension silica-based particles and at least one charged organic polymer, forming and draining the suspension on a wire, characterised in that the silica-based particles are obtained by a process  
30 according to any of claims 1 to 9 or present in an aqueous sol according to any of claims 10 to 16.

19. Process for the production of paper which comprises:

- (a) providing an aqueous suspension containing cellulosic fibres, and optional fillers;
- (b) providing an aqueous sol containing silica-based particles, the sol having a specific  
35 surface area of at least 90 m<sup>2</sup>/g aqueous sol and the silica-based particles having a specific surface area of less than 1000 m<sup>2</sup>/g SiO<sub>2</sub>;

- (c) providing at least one charged organic polymer;
- (d) adding the charged organic polymer and the silica-based particles to the suspension;
- (e) forming and draining the obtained suspension on a wire.

20. Process for the production of paper which comprises:

- 5 (a) providing an aqueous suspension containing cellulosic fibres, and optional fillers;
- (b) providing an aqueous sol containing silica-based particles having a specific surface area of at least  $90 \text{ m}^2/\text{g}$  aqueous sol and an S-value within the range of from 10 to 45%;
- (c) providing at least one charged organic polymer;
- (d) adding the charged organic polymer and the silica-based particles to the suspension;
- 10 (e) forming and draining the obtained suspension on a wire.

21. Process according to claim 19 or 20, c h a r a c t e r i s e d in that the sol has a specific surface area in the range of from 95 to  $150 \text{ m}^2/\text{g}$  aqueous sol.

22. Process according to claim 19, 20 or 21, c h a r a c t e r i s e d in that the silica-based particles have a specific surface area of at least  $550 \text{ m}^2/\text{g SiO}_2$ .

- 15 23. Process according to any of claims 19 to 22, c h a r a c t e r i s e d in that the charged organic polymer is cationic starch or cationic polyacrylamide.

24. Process according to any of claims 19 to 23, c h a r a c t e r i s e d in that the aqueous sol is diluted to a silica content of from 0.05 to 5% by weight before adding the silica-based particles to the suspension.

- 20 25. Process according to any of claims 19 to 23, c h a r a c t e r i s e d in that the silica-based particles are added to the suspension in an amount of from 0.005 to 0.5% by weight, calculated as  $\text{SiO}_2$  and based on dry cellulosic fibres and optional fillers.

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